



## **Intelligence Report**

*Office of Resources, Trade, and Technology*

# **Eastern Zaire's Humanitarian Crisis: Scope and Impact** [REDACTED]

*A Research Paper*

~~Secret~~

RTT 94-10075  
December 1994

Copy

391

**Warning Notice**

Intelligence Sources  
or Methods Involved  
(WNINTEL)

**National Security  
Information**

Unauthorized Disclosure  
Subject to Criminal Sanctions

<b>Dissemination Control Abbreviations</b>	NOFORN (NF)	Not releasable to foreign nationals
	NOCONTRACT (NC)	Not releasable to contractors or contractor/consultants
	PROPIN (PR)	Caution—proprietary information involved
	ORCON (OC)	Dissemination and extraction of information controlled by originator
	REL...	This information has been authorized for release to...
	WN	WNINTEL—Intelligence sources or methods involved

All material on this page  
is Unclassified.



## **Intelligence Report**

---

*Office of Resources, Trade, and Technology*

# **Eastern Zaire's Humanitarian Crisis: Scope and Impact** [REDACTED]

*A Research Paper*

This Intelligence Report was prepared at the request of the Department of State by the Geographic Resources Division, Office of Resources, Trade, and Technology, with contributions from the [REDACTED] Office of African and Latin American Analysis, the Office of Imagery Analysis, and the Defense Intelligence Agency, PGI-IA.

Comments and queries are welcome and may be directed to [REDACTED]  
RTT, [REDACTED]

## Eastern Zaire's Humanitarian Crisis: Scope and Impact [REDACTED]

### **Key Findings**

*Information available  
as of 23 November 1994  
was used in this report.*

*The mid-July influx of 1.2 million Rwandan refugees to Zaire's eastern border provinces created a humanitarian crisis that is likely to persist for at least another six months.* The sheer size of the refugee population dictates enormous relief requirements:

- More than 85 international nongovernmental organizations (NGOs) are involved in the relief efforts; food requirements alone exceed 600 metric tons per day, according to UN World Food Program estimates. [REDACTED]

*Although the emergency has eased as relief has flowed into the region, conditions in the camps remain poor:*

- *Deteriorating security has become the most severe constraint to relief efforts, especially in the Goma region.* Violence in the camps plagues both refugees and relief personnel; a number of NGOs have threatened to pull out of camps controlled by Hutu militia and ex-government politicians.
- Relief efforts have not ended malnutrition, disease, and poor sanitation.
- In addition, the camps in the Goma region remain vulnerable to volcanic and other natural hazards.

Meanwhile, relief deliveries face formidable logistic constraints—long distances to the remote and underdeveloped region, inadequate local infrastructure, and the mid-September-to-May rainy season. [REDACTED]

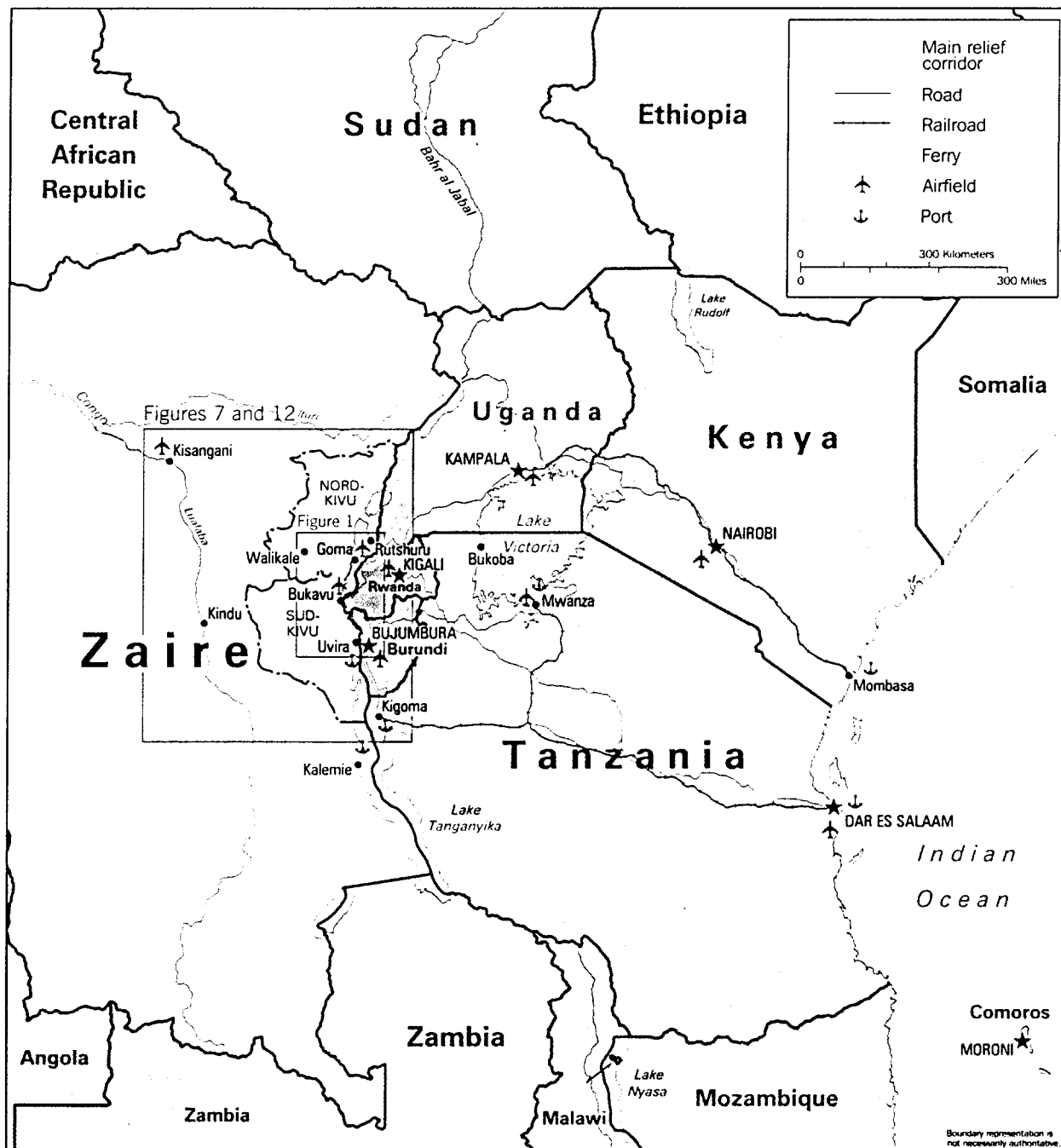
*The crisis is exacerbating eastern Zaire's longstanding demographic, economic, and security problems:*

- The refugees are concentrated in a zone that already had one of the highest population densities in Africa.
- The influx is reigniting ethnic tensions in the region, according to press and diplomatic reports, and already has sparked violence.
- The crisis has hurt local agriculture, commerce, tourism, community life, and the environment and has disrupted already deteriorated trade relations with neighboring Rwanda as well as with Burundi. [REDACTED]

*The instability increases the possibility of a regional conflict.* Observers are increasingly concerned that the Tutsi-dominated Kigali regime will launch retaliatory military strikes into Zaire in response to refugee-directed raids from Zaire into Rwanda or of an insurgency mounted against Kigali by former Rwandan armed forces. Moreover, the Tutsi-controlled military in Burundi is concerned about extremist Hutu refugees just across its border with Zaire. [REDACTED]

## Contents

	<i>Page</i>
Key Findings	iii
The Scope of the Crisis	1
Refugee Camp Conditions	1
Security Concerns	5
Relief Delivery Hurdles	6
Problems Beyond the Immediate Crisis	7
Demographic and Ethnic Pressures	7
Economic Disruptions	9
Threats to Stability	11
Appendixes	
A.    Terrain, Climate, and Vegetation	13
B.    Eastern Zaire's Natural Hazards	15
C.    Economy and Resources	17



## Eastern Zaire's Humanitarian Crisis: Scope and Impact

### The Scope of the Crisis

The UN estimates that there are 1,470,000 recent refugees—about 20 percent of Sub-Saharan Africa's refugee population—in the densely populated and ethnically fractious portions of the eastern Zairian Regions of Nord-Kivu and Sud-Kivu. Some 1.2 million of these are Rwandan Hutus who fled their country in July and August following the victory of the Rwandan Patriotic Front insurgents. An estimated 850,000 of these refugees are in Goma and in camps north and west of town; another 300,000 are in Bukavu and in 28 small camps nearby.<sup>1</sup> Most of the remaining 320,000 refugees—about 80 percent of whom are Burundians—are located along the Ruzizi River plains north of Uvira. In addition, the Kivus have tens of thousands of Rwandans who fled during earlier periods of turmoil, although US Embassy reports indicate that some are returning to Rwanda.

The humanitarian needs of the refugee population are huge. The UN High Commission for Refugees (UNHCR), which is coordinating relief efforts in eastern Zaire, requested \$115 million for the effort between mid-July and mid-October. This did not cover supplies from other UN agencies, such as the UN Children's Fund, the World Health Organization, and the World Food Program, which are working with the International Committee of the Red Cross, Medecins Sans Frontiers (MSF), and more than 85 other nongovernmental organizations (NGOs) to provide food, water, medical services, shelter, and sanitation to refugees in the region.

### Refugee Camp Conditions

The acute initial phase of the emergency has ended, and death rates in the Goma camps have fallen from

<sup>1</sup> An estimated additional 100,000 to 150,000 recent Rwandan refugees in the Bukavu Region are not included in this number because they do not need assistance. In addition, many of the 5,000 to 6,000 Tutsis who fled Bukavu and the 10,000 who fled to Goma in April have returned to Rwanda, according to diplomatic reporting.

### Goma and Bukavu: Main Cities

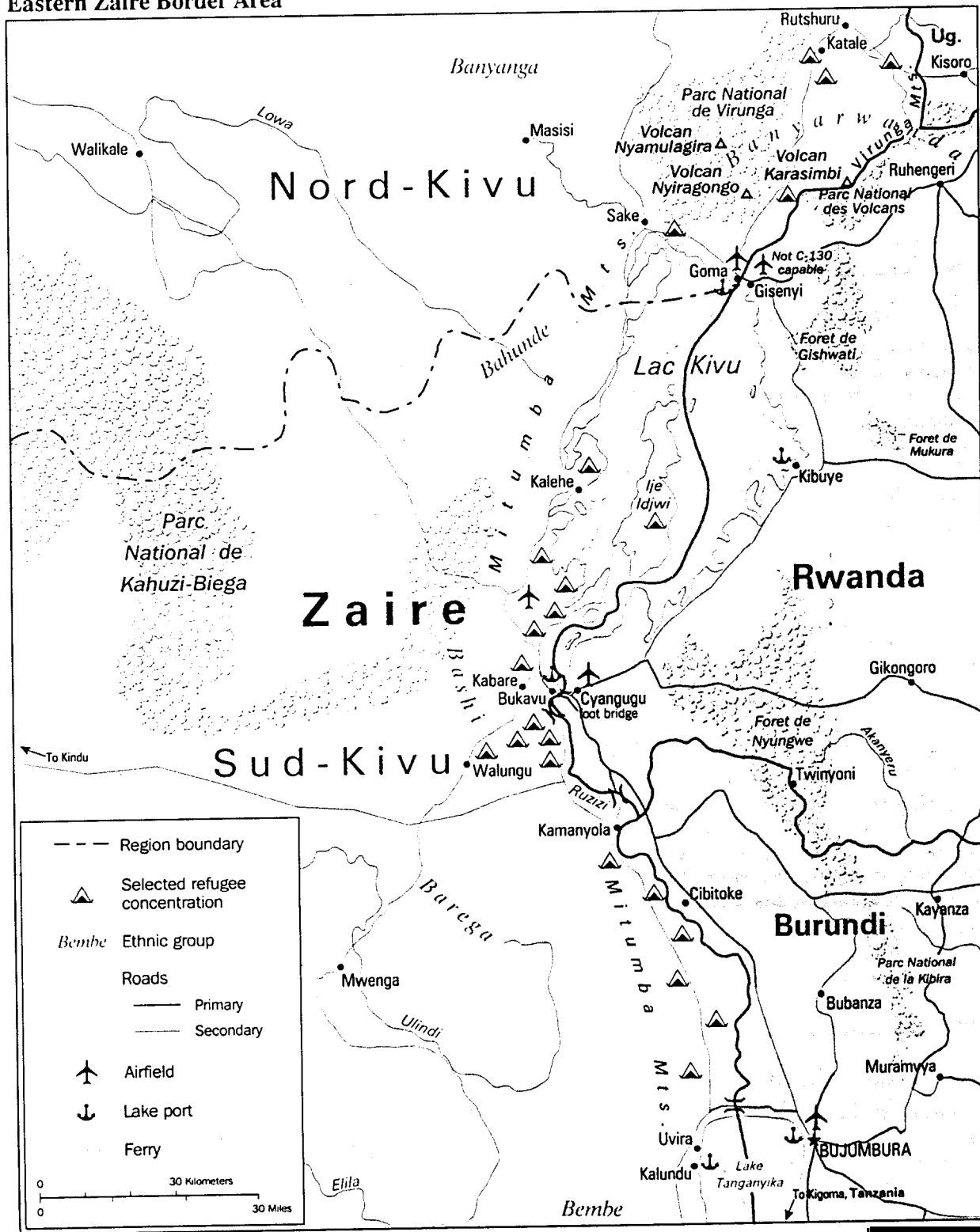
*Goma—with a population of 150,000 before the recent influx of Rwandan refugees—is an important center of economic activity in Nord-Kivu. The town has long been a transportation hub because of its relatively large airport, links to Rwanda's good roads, command of the Lac Kivu ferry traffic, and proximity to coffee-smuggling routes through Rwanda and Uganda, according to a US Embassy report. Its importance has grown since 1988 when Nord-Kivu became a separate region. Goma has few industries—notably tea and coffee processing—and a ramshackle commercial section. The town's moderate climate—afforded by its 1,500-meter elevation—and its location near Lac Kivu, the Nyiragongo and the Nyamulagira volcanoes, and Parc Nationale de Virunga attract some tourists. Well-to-do Zairians—including President Mobutu—maintain villas along the lake.*

*Bukavu, the economically depressed capital of Sud-Kivu—with a precrisis population of 250,000—is densely settled. Like Goma, it is a business, government, and minor resort town; it is also an educational center. Over the years, local nongovernmental organizations (NGOs) and development organizations have been particularly active in Bukavu. It is 24 km southwest of Parc Nationale de Kahuzi-Biega. The town's limited industry is based on the processing of agricultural products.*

35/10,000 per day in July to 1.3/10,000 per day—slightly above the internationally accepted norm of 1/10,000 per day in a refugee situation. Nonetheless, conditions in the refugee camps remain poor.

Cases of *malnutrition* are widespread, according to US Embassy reports, especially among young children and in households headed by women. Health officials attribute the problem to gaps in the food pipeline, an improper nutritional mix, and security problems

Figure 1  
Eastern Zaire Border Area



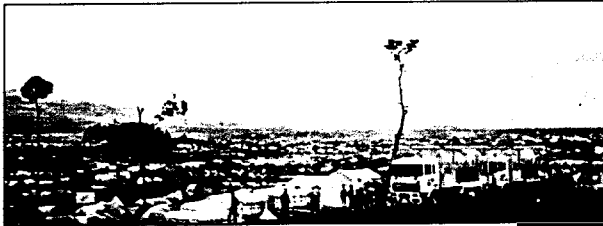


Figure 2. Water tankers deliver potable water to Kibumba refugee camp north of Goma. Ground and surface water are largely absent in this camp.

that prevent equitable distribution of food in the camps. In late August, relief workers reported a high incidence of malnutrition in the Goma area camps. A nutritional survey in Mugunga camp indicated that 16 percent of children under age five in male-headed households and 27 percent of those in female-headed households were malnourished. In Kibumba camp, more than one-fifth of the children under five were malnourished; 3 percent were severely malnourished. A followup survey conducted in October concluded that malnutrition rates had increased since August, according to US Embassy reports. Diplomatic reporting indicates that food relief shortfalls and violence are affecting food distribution in camps in the Uvira area and have created pockets of malnutrition in camps near Bukavu.

Although the minimum requirements for clean water are being met in most camps, the supply of water is still inadequate in some. This is a concern because relief workers believe that a lack of potable water and poor sanitation were responsible for the rapid spread of cholera and bloody diarrhea that caused the majority of the 50,000 deaths recorded in camps in the Goma area in the month following the massive influx. Shortages of water purification equipment and the incidence of waterborne diseases—which are still widespread throughout the Kivus—were reported in early October in some Bukavu area camps, according to USAID's Office of Foreign Disaster Assistance (OFDA). Moreover, supplies remain vulnerable to disruption because clean water must be trucked into several of the camps.

Efforts to improve camp sanitation are proceeding slowly. The needs remain particularly great in the Goma area, where the hard volcanic rock surface



Figure 3. Children at water tap in Kashusha refugee camp near Bukavu. The water is piped from Lac Kivu.

inhibits digging; OFDA reports indicate that, as of early October, only one latrine existed for every 100 persons, and many of the existing latrines needed to be closed. Conditions are also poor in the Bukavu area, where limited land for camp sites has caused severe overcrowding, according to US Embassy reports.

Disease remains pervasive. The cholera epidemic has been contained, but deaths from bloody diarrhea continue. Other problems include nonbloody diarrhea, malaria, and acute respiratory diseases. Refugee officials expect that incidences of the latter two will increase as the rainy season (mid-September through May) progresses. Intestinal diseases are endemic to the region, and periodic outbreaks should also be expected, according to US military doctors. In addition, relief workers are concerned about the probably high prevalence of HIV infection among refugees.

Finally, the camps in the Goma area remain at risk from volcanic activity.<sup>2</sup> Although refugees have been moved from the most vulnerable location, continued

<sup>2</sup> For more information on the region's physical geography and natural hazards, see appendixes A and B.

Figure 4.

A. Refugee father cares for his motherless child. ■

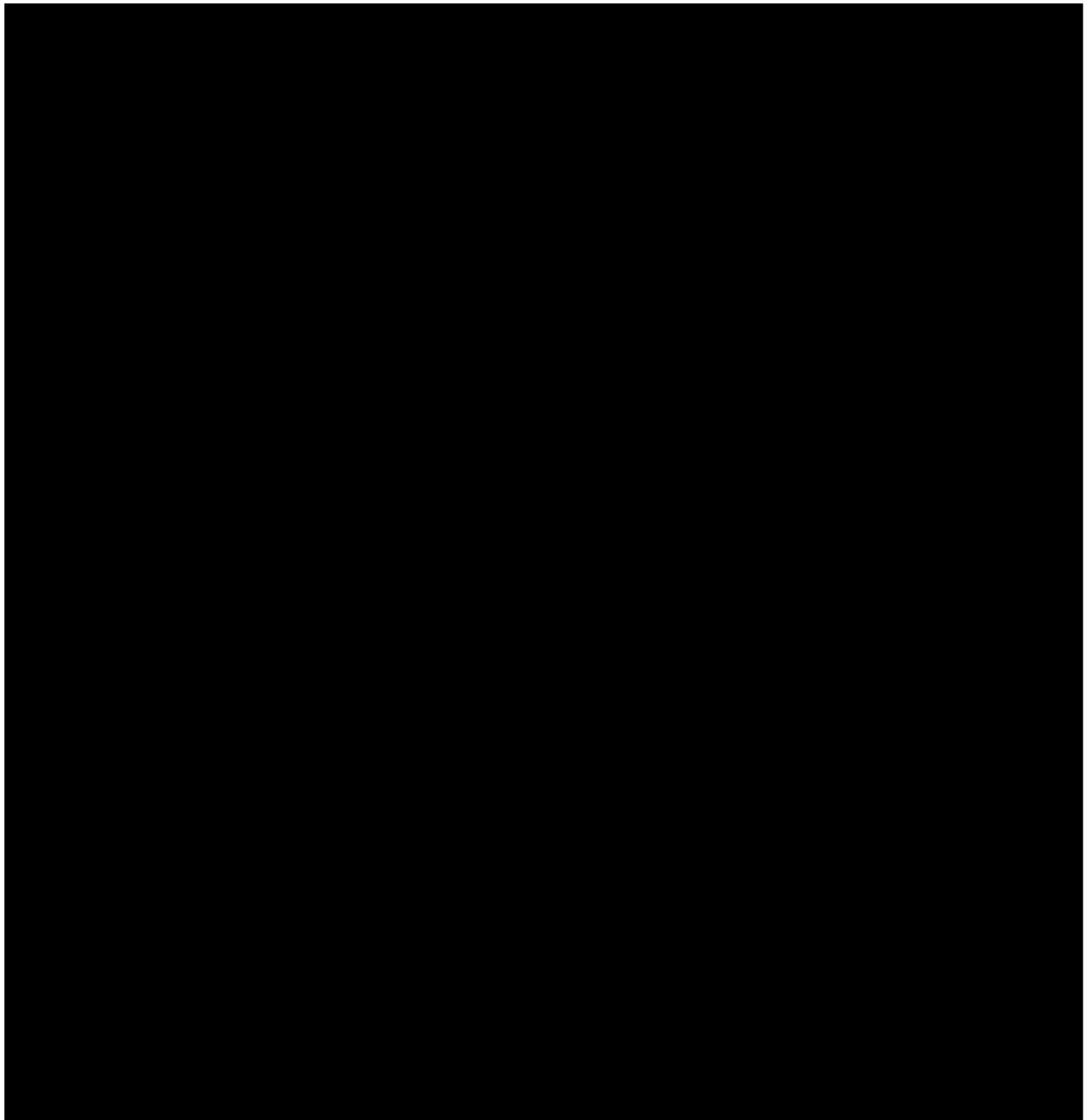
B. Stark conditions at Kibumba camp, mid-August 1994. ■

C. Relief workers prepare to move wooden slats that will be used in the construction of makeshift latrines. The slats will be laid over rock crevices. ■

D. Unaccompanied children in Kibumba camp. One of the major problems facing relief agencies is the need to provide care for the estimated 20,000 unaccompanied children in eastern Zaire—about 12,000 are located in the Goma area. ■

E. Medecins Sans Frontiers hospital tent in Kibumba camp. ■





relocation and development of evacuation plans for camps near the region's two active volcanoes are needed. All existing and proposed refugee camp sites in the Goma area are located on relatively young lava flows, which are considered uninhabitable by locals

because they eventually will be buried by new lava, according to a US Geological Survey report. Scientists believe that refugees in low-lying camps west of Goma also face a threat from carbon dioxide gas. ■

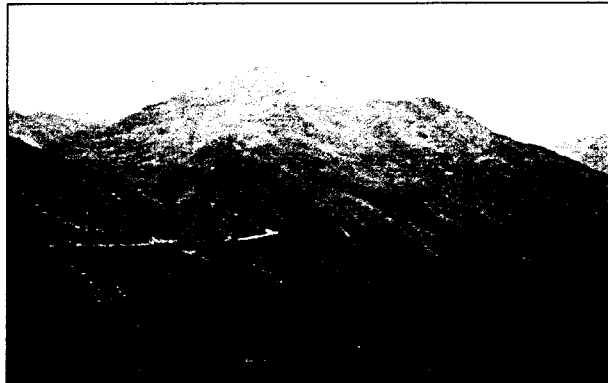
### Security Concerns

Deteriorating security in the camps has become the most severe constraint to relief efforts. Disorder and violence occur routinely in the Goma camps, and it has become virtually impossible for NGOs to operate in some, [REDACTED]. In late September, food distribution was suspended for a week following an incident in the Katale camp that forced the evacuation of relief workers and resulted in the effective takeover of the camp by many of the same elements that were responsible for the genocide in Rwanda. In early November, some 16 relief groups threatened to pull out of camps around Goma because of security conditions. Relief workers in camps near Bukavu—citing frequent killings, looting of relief supplies, and extortion—are concerned about the lack of security and the high levels of violence, according to diplomatic reporting. Indeed, MSF/France halted its operations in the Bukavu Region in mid-November. [REDACTED]

Soldiers from the former Rwanda Armed Forces (FAR) and Hutu militias remain organized and armed inside Zaire and have become increasingly aggressive:

- In the Goma area, as many as 22,000 FAR troops are encamped some 20 kilometers (km) northwest of the town. Many have weapons—including some heavy weapons—and access to numerous vehicles. FAR troops have attacked Tutsi refugee camps, killed moderate Hutus who have advocated that refugees return to Rwanda, and robbed relief convoys, according to diplomatic reporting.
- Several kilometers south of Bukavu, some 5,000 to 7,000 FAR soldiers are encamped. [REDACTED]
- There are well over 10,000 Hutu militiamen in eastern Zaire; many act as enforcers for Hutu extremists, kill moderate Hutus, and hinder relief operations. The militiamen are particularly well organized in the Goma area where, along with ex-politicians, they control food distribution in several camps. [REDACTED]

The 2,000 to 2,500 Zairian troops in the Kivus—including as many as 1,000 of President Mobutu's



*Figure 6. Overland route between Bujumbura and Bukavu cuts steeply through mountainous terrain between Bukavu and Uvira.* [REDACTED]

security forces—do little to bolster security and sometimes undermine it. Zairian forces are stretched thin, lack rudimentary military discipline, and suffer economic hardship. [REDACTED] Press [REDACTED] reporting indicate that they regularly engage in violent criminal activity, threaten relief efforts, and clash with Rwandan refugees and soldiers. [REDACTED]

In addition, the presence of more than 200,000 Rwandan and Burundian Hutu refugees in Sud-Kivu near the Burundian border is undermining security in that region. Bujumbura views the Hutu refugees as potential anti-Tutsi insurgents and as a base of support for extremist Hutu forces inside Burundi, according to diplomatic reporting. Burundian officials have demanded that Western relief agencies move the refugees from the border and strenuously objected when additional refugees were relocated to the area from camps around Goma in mid-October:

- Burundian Army troops have crossed into Zaire several times since mid-October in pursuit of Hutu guerrillas, according to diplomatic reporting.

### Relief Delivery Hurdles

In addition to health and security problems in the camps, humanitarian organizations face the logistic challenge of transporting some 600 metric tons of food per day—as well as medicine and other supplies—over long distances to remote locations. Because overland links between the Kivus and the rest of Zaire are not good, the refugees—who are concentrated along Zaire's eastern border—are supplied via the East African rail and road corridors from ports on the Indian Ocean that are between 1,400 km and 1,800 km from the camps.<sup>3</sup> Although two hard-surfaced, C-130-capable airfields are near Goma and Bukavu, logistic experts indicate that they lack the capacity to hand a large volume of relief goods. [REDACTED]

Goma, which is supplied largely from Mombasa via Uganda and Rwanda, is more accessible than Bukavu, which is supplied primarily from the port of Dar es Salaam via Bujumbura. Moreover, the roads and the airfield that serve Goma are in better condition and can sustain greater volumes of traffic than can those that serve Bukavu. Uvira is supplied via 35 km of relatively good road from Bujumbura or via barge from the Tanzanian port of Kigoma on Lake Tanganyika; relief officials believe that Kalundu port, 4 km south of Uvira, can handle 300 metric tons of food per day. The need to transship many of the goods to Bukavu and Uvira increases the probability of logjams and costly delays. [REDACTED]

Once the aid reaches eastern Zaire, distribution is hindered by poor primary and secondary roads, which deteriorate under the heavy flow of goods and seasonal rains. Facilities at the lake ports of Goma and Bukavu are also limited. Moreover, refugees in the Bukavu area are dispersed in a relatively large number of small, poorly accessible camps, according to a US Embassy report. [REDACTED]

Fuel supply and storage problems compound these transport difficulties:

- Petroleum-based fuels must be trucked overland to the Kivus from Kenya via Uganda, Rwanda, or Burundi, [REDACTED]

- Diplomatic sources report that severe shortages of diesel fuel, gasoline, and aviation fuel are common throughout the region.
- With the exception of a 5,000-barrel fuel depot at Uvira, little storage capacity exists in the eastern Kivu Region, [REDACTED]

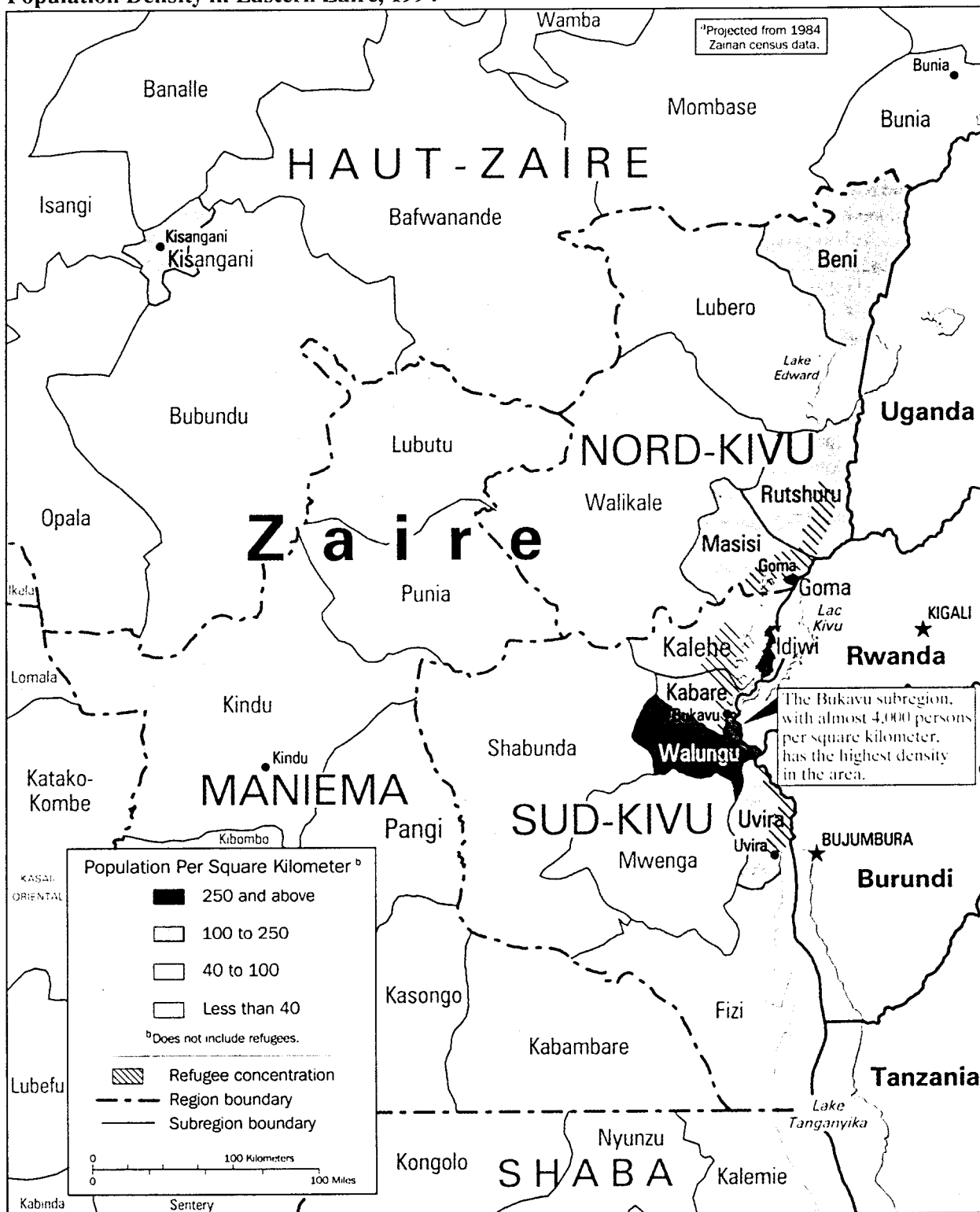
### Problems Beyond the Immediate Crisis

#### Demographic and Ethnic Pressures

The expected prolonged refugee presence in the Kivus is likely to aggravate local demographic pressures. The easternmost portions of Nord-Kivu and Sud-Kivu are among the most densely populated in Africa; densities resemble those that existed in adjacent portions of Rwanda. The recent influx increased the population of the Kivus—which was more than 6.3 million before the crisis, according to projections made from the 1984 Zairian census—by 18 percent. Rwandan refugees are occupying schools, churches, and common areas and are disrupting community services. Moreover, there is a history of tensions between local residents and earlier waves of refugees, according to a US Embassy report. [REDACTED]

In addition, because the recent Rwandan refugees—both Hutu and Tutsi—are ethnic Banyarwandans, their presence is playing into longstanding ethnic tensions in the region over land ownership and citizenship status. Other ethnic groups—the Bahunde, the Banande, and the Banyanga in the north and the Bashi, the Barega, and the Babembe in the south—have frequently clashed with Banyarwandan residents as well as with each other. The Banyarwanda—mostly Hutus who began arriving in the Kivus in the mid-19th century—are estimated to make up almost 50 percent of Kivu's population and are concentrated in the border zone, according to academic sources. Although no demographic data details ethnic membership, the US Embassy estimated that in 1982 there were 1 million former Rwandans, mainly Hutus, living in the Kivus. Recent US Embassy and press reports cite a resurgence of ethnic violence in the

**Figure 7**  
**Population Density in Eastern Zaire, 1994<sup>a</sup>**



### *Kinshasa and the Kivus*

*The Kivus are politically distant from the capital; their autonomy is traced back to conditions that existed in the colonial era. The Belgians made little effort to establish authority in the region, preferring instead to work through existing tribal structures,*

*At independence these tribal organizations strongly resisted Kinshasa's attempts to gain control, and local ethnic groups formed the backbone of the People's Revolutionary Party—a small insurgent group that challenged Kinshasa's authority in the area through the early 1980s. Since then, the central government has made only limited headway in increasing its control. Current Prime Minister Kengo and his predecessor claim roots in the Kivus, but neither has public support in the region, according to diplomatic reporting. US Embassy reports indicate that many residents of Nord-Kivu back Zairian President Mobutu's party, the Popular Movement of the Revolution—before 1991, the country's sole, legal party—and most locals are wedded to the political status quo; Sud-Kivu, on the other hand, is a hotbed of opposition sentiment.*

Masisi area, west of Goma, where local Hutus, possibly bolstered by former FAR elements and the militia, are leading the fight against the local Bahunde, while Zairian Tutsi are fleeing the area. Relief workers estimate that the violence has resulted in the death of 250 villagers as well as the displacement of 34,500 others.

Competition for land, an important source of ethnic rivalry, is likely to grow worse. The Banyarwanda's large numbers and traditional agricultural skills have fueled conflict with other ethnic groups over control of agricultural land. In late 1993, such a conflict resulted in the deaths of an estimated 6,000 Banyarwandans and the displacement of another 350,000, according to diplomatic reporting.

With national elections required by July 1995, the voting rights of the Banyarwanda are likely to be a major source of ethnic tension. The issue of citizenship has frequently been a point of contention between local

ethnic groups and the Banyarwanda, who enjoyed full citizenship until President Mobutu insisted in 1981 that citizens be able to trace their roots to 1885. President Mobutu postponed elections in Nord- and Sud-Kivu in February 1988 because he feared that tensions over voter eligibility would lead to violence between the Banyarwandans and other groups, according to a US Embassy report.

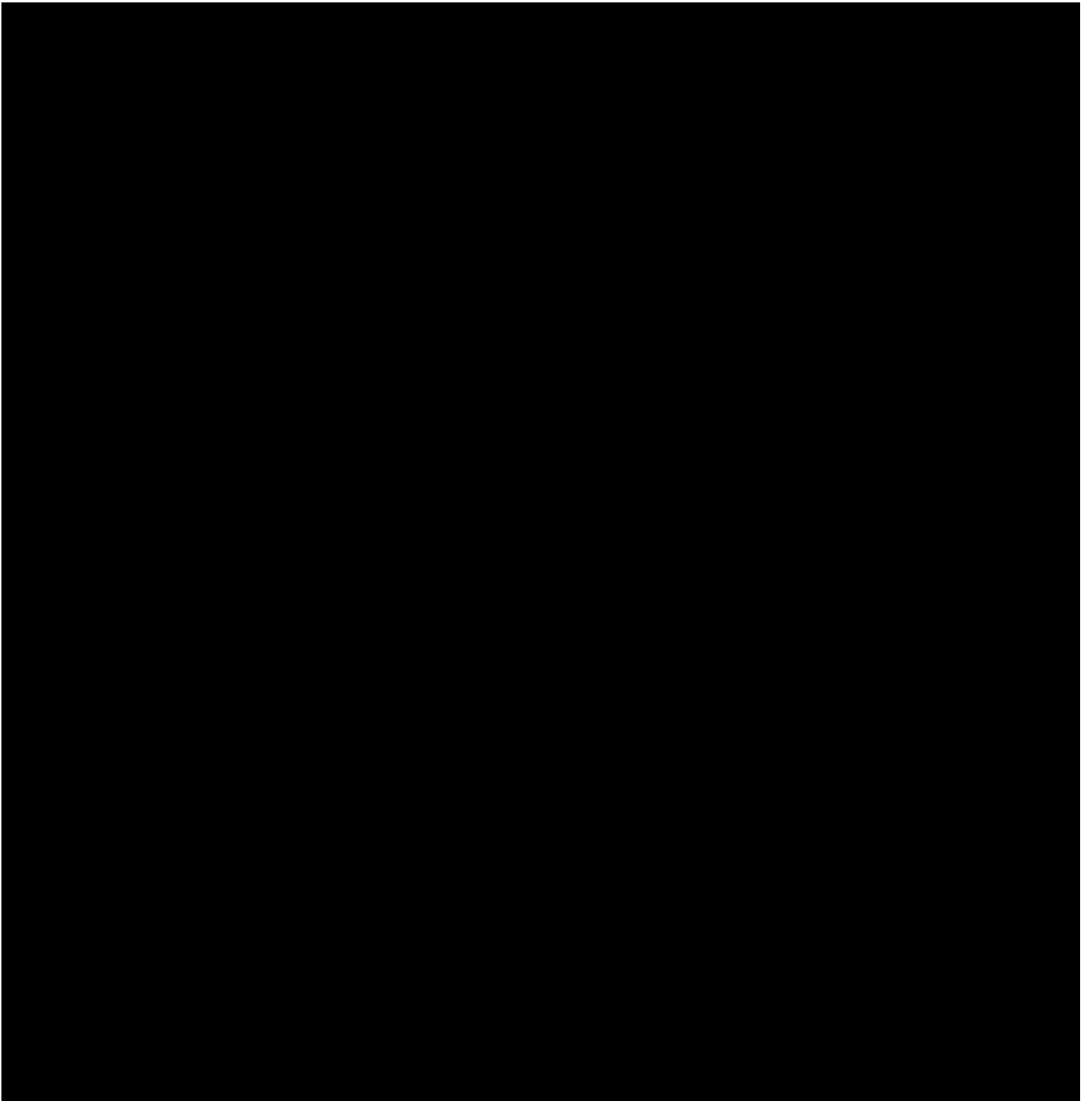
### **Economic Disruptions**

The influx of refugees is harming the local economy and the environment:<sup>4</sup>

- In the Bukavu area, agriculture—the mainstay of the local economy—has been disrupted. Refugees have occupied farmers' fields and have delayed fall planting, according to press and diplomatic reporting.
  - Many refugees prefer cassava, bananas, goats, and chickens to UN-provided rations and are stealing from local farmers, according to a press report. Demand for local food has driven prices beyond what the local poor can pay and has enticed farmers to sell household reserves.
  - Tourism—although never a major source of income—has been almost completely halted.
  - Foraging refugees are depleting the area's firewood and its charcoal derivative; of particular concern is the deforestation taking place within Parc National de Virunga.
  - According to OFDA, many camps in the Bukavu area are located on hillsides and are exacerbating erosion and risking landslides.
- Instability in neighboring countries is also aggravating economic problems:
- The turmoil in Rwanda has disrupted the Kivus' longstanding trade with Rwanda and Burundi (agricultural products are exported for manufactured

<sup>4</sup> For more details on the economy and resources, see appendix C.

~~Secret~~



~~Secret~~



*Figure 9. Mudslides partially cover the road adjacent to a small hillside refugee camp near Bukavu at the beginning of the rainy season. Zairians are increasingly concerned about the environmental consequences of the refugee situation.*

goods and fuel, according to the US Embassy), and the breakdown of order in Burundi probably will exacerbate the problem:<sup>5</sup>

- The disorder has also interrupted communication links. Diplomatic reporting indicates that almost every business or NGO in the border region had relied on Rwanda's communications system by maintaining post office boxes, fax machines, and telephones across the border.

<sup>5</sup> The Kivus are virtually economically independent of Kinshasa; most business transactions are conducted in dollars rather than in the Zairian currency, few tax revenues flow to the Central Bank, and the area's traditionally abundant agricultural resources and trade with eastern neighbors limit the need for the Kivus to import goods from the rest of Zaire.

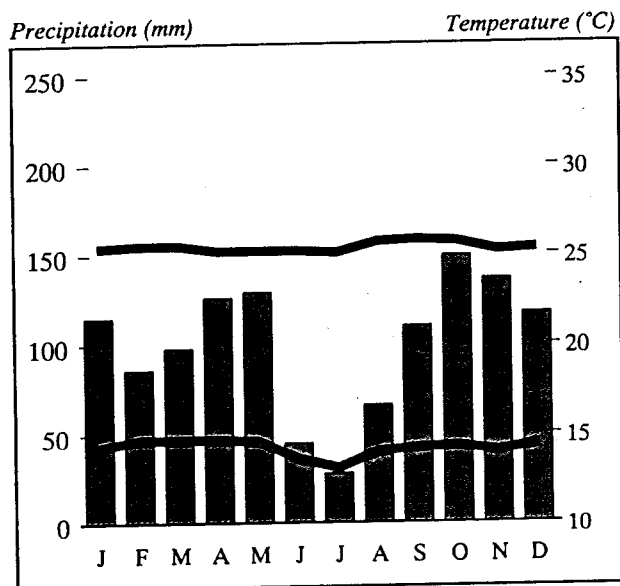
### Threats to Stability

The deterioration of security in the camps and clashes between refugees and local residents are threatening stability in the Kivus and are increasing the possibility of regional conflict. Moreover, diplomatic reports indicate that former Rwandan soldiers in Zaire remain loyal to their commanders and are conducting small-scale military operations against the new Tutsi-dominated government in Rwanda. Such operations, as well as further incursions of Hutu militia into Rwanda, may well provoke retaliation by Kigali, including cross-border raids to disrupt insurgent activity. Meanwhile, the potential for an insurgency directed by extremist Hutu elements in Zaire against the Burundian Tutsi seems to be growing.

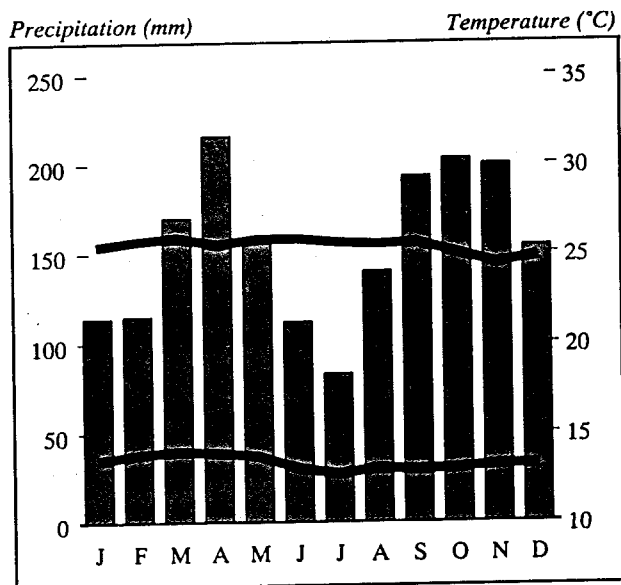
**Figure 10**  
**Climate**

■ Precipitation    — Mean Maximum Temperature    — Mean Minimum Temperature

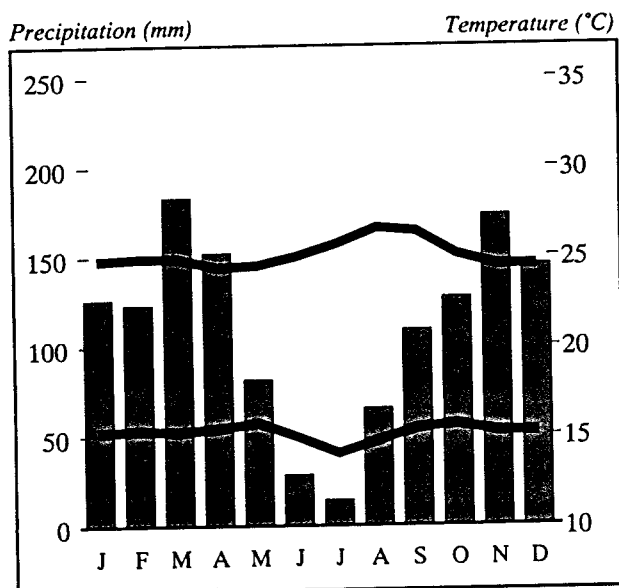
**Goma**



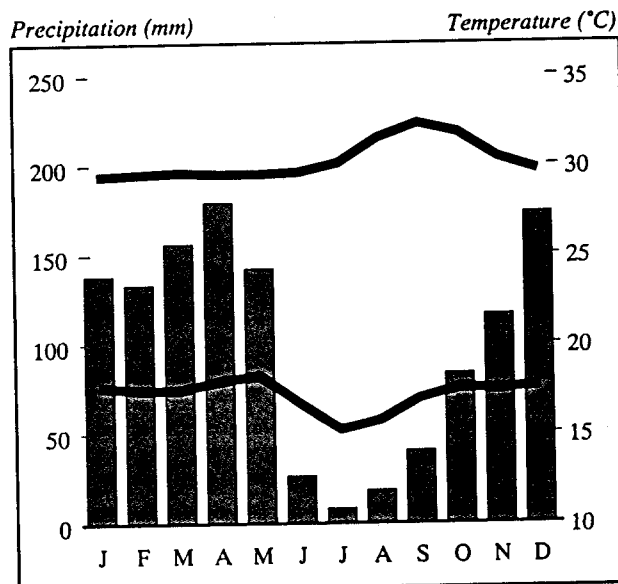
**Rumangabo**



**Bukavu**



**Lubarika**



## Appendix A

### Terrain, Climate, and Vegetation

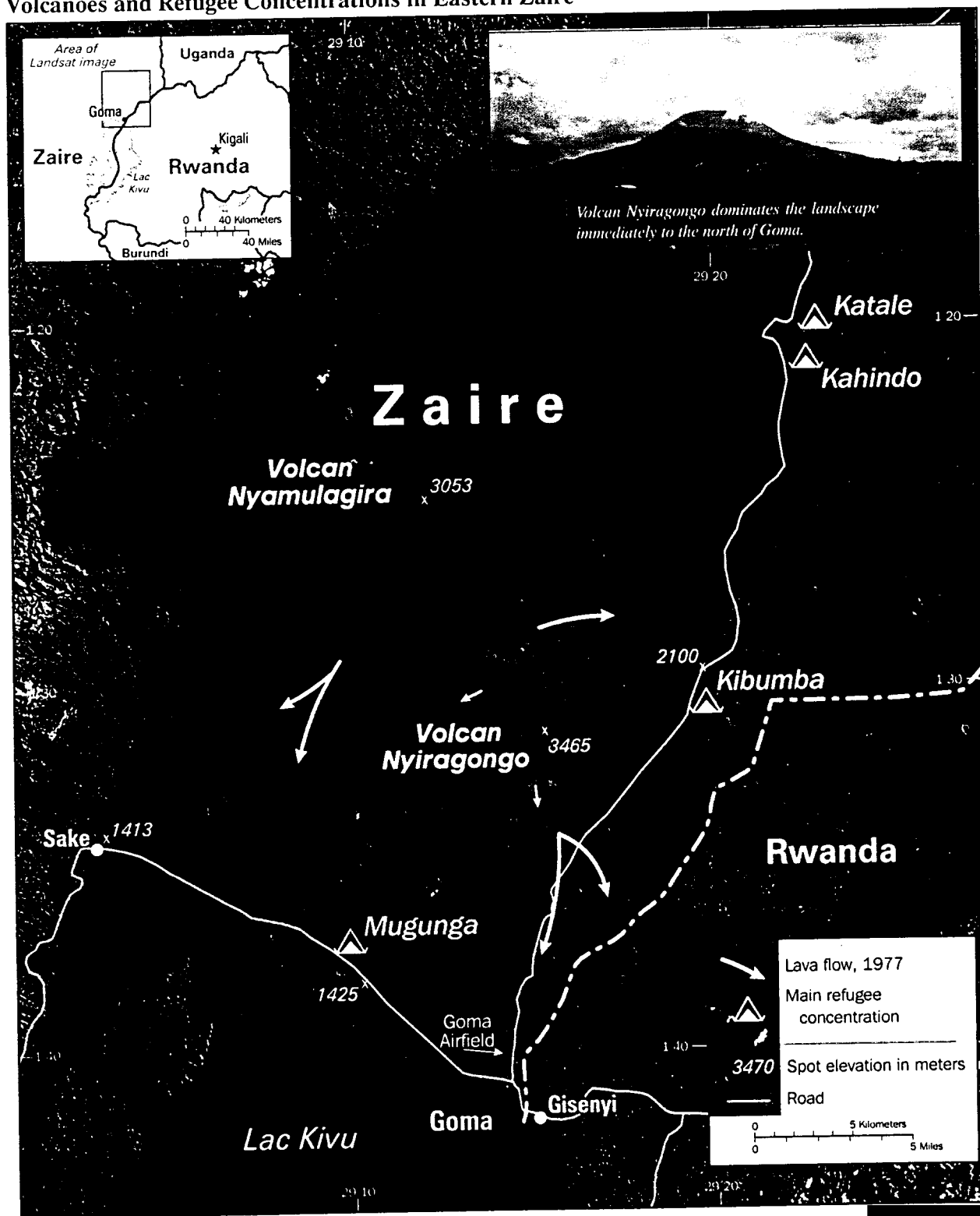
The primary features of Zaire's eastern border terrain are the Mitumba and Virunga mountain ranges and the Great Rift Valley. The Mitumba Mountains—with peaks over 3,000 meters—form the western arm of the Great Rift Valley; the eastern slopes of the mountains plunge from about 2,500 meters elevation to the valley approximately 1,100 meters below. Lac Kivu, the Ruzizi River that drains it, and Lake Tanganyika occupy much of the narrow Rift Valley's relatively flat floor. The broadest portion of the valley is located near Uvira. The volcanic Virunga Range cuts across the valley to the north of Lac Kivu, where it forms the divide between the Congo and the Nile Rivers. The terrain in western portions of the Kivus is hilly. ■

The region's climate is generally mild. Because of the proximity to the equator, temperatures vary little throughout the year. Monthly means of 22°C to 24°C occur at lower elevations and of 15°C above 1,800 meters. For most of the year, precipitation averages nearly 150 millimeters (mm) per month; the June-August period is drier, with rainfall varying between 40 and 80 mm. Precipitation increases near the lakes and at higher elevations. By comparison, temperatures in Washington, DC, range from an average 1°C in January to 25°C in July, and monthly precipitation averages 89 mm. ■

Natural vegetation throughout the region varies with local climate and soil conditions:

- Mosses and herbs grow on the younger lava flows from the Virunga Range, which cover the plains north of Goma, while shrubs and trees grow on the older flows.
- Where unaltered by cultivation, the Rift Valley floor is covered mainly with short grass, flowering plants, cactus-like plants, small acacia trees, and palms. Along the streams there are fringe forests of spiny date palms; in areas of poor drainage, elephant grass and reeds grow.
- Natural vegetation on the walls of the valley change as elevation, rainfall, and humidity increase—from grass, to deciduous forest, to evergreen forest with dense undergrowth, to bamboo forests at the highest elevations. On the western slopes of the Mitumbas, the sequence is much the same except that here the grassy hills become tropical rain forest as they descend westward into the Congo basin. ■

**Figure 11**  
**Volcanoes and Refugee Concentrations in Eastern Zaire**



## Appendix B

### Eastern Zaire's Natural Hazards

The population of the region is vulnerable to three main natural threats—volcanic eruptions, high concentrations of carbon dioxide (CO<sub>2</sub>) gases, and the degassing of lake waters. ■

Two volcanoes, Volcan Nyiragongo and Volcan Nyamulagira, are located near Goma and area refugee camps and have been active frequently during the past century—most recently during the summer of 1994.<sup>6</sup> According to scientists, the principal dangers posed by the volcanoes are twofold:

- First, a major eruption may occur with little warning, and lava could quickly engulf an extensive area. The magma that feeds both volcanoes is unusually fluid; during Nyiragongo's last major eruption in 1977, a lake of molten lava burst through several fissures in the volcano's flanks simultaneously and moved over the countryside at more than 50 kilometers (km) per hour, according to Japanese seismologists. According to a September 1994 US Geological Survey (USGS) report based on recent field research, however, scientists assessed that the danger of a life-threatening eruption occurring over the next few months had diminished.
- Second, ash plumes from the volcanoes could disrupt air relief operations. In 1991, a South African aircraft lost two of its four engines when the pilot failed to detect small particles from the volcano's ash plume and flew the plane through it.

<sup>6</sup> On 23 June 1994 an eruption occurred in the central cone of the Nyiragongo crater; it was followed by a small lava flow from the northwestern flank of Nyamulagira on 4 July. During the following month, the two volcanoes—connected by subsurface channels—emitted ash and steam plumes on several occasions; on 8 August tremors were felt in the Goma area, followed two days later by a lava flow from a fissure on the southern slope of Nyiragongo. ■

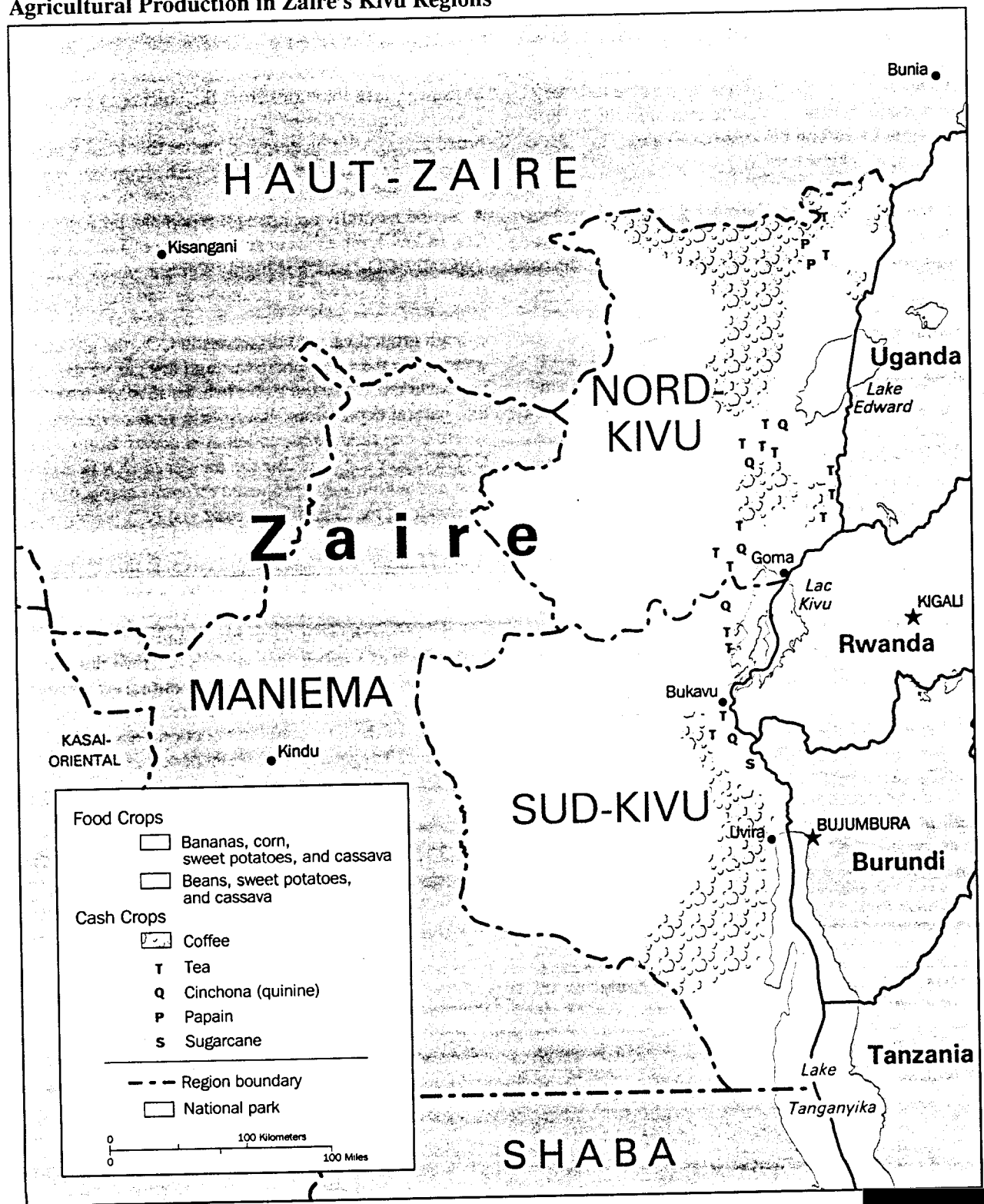
Moreover, lava fountains from the volcanoes can also spew large quantities of glassy volcanic ash over broad areas. After an eruption earlier this year, a number of cattle died from ingesting such sharp ash. ■

A second naturally occurring threat is the presence of CO<sub>2</sub> in low-lying areas near the shores of Lac Kivu. Typically, CO<sub>2</sub>, which is highly soluble, poses little threat; it is dissolved in groundwater and transported to the surface at soda springs. If, however, there is not enough groundwater to dissolve the CO<sub>2</sub>, the gas can escape into the atmosphere through dry gas vents (*mazukus*); because the gas is heavier than air, it flows into natural depressions, basements, or excavations where it can accumulate in lethal concentrations. The USGS report suggests that the danger of CO<sub>2</sub> is high near and within some proposed refugee camps, particularly along the Goma-Sake road. ■

A third but more remote natural threat is that of degassing from Lac Kivu. The lake contains vast quantities of dissolved CO<sub>2</sub> and methane that could be released into the atmosphere in the event of a major disturbance, such as a subsurface landslide, a lava flow into the lake, or an eruption on the lake bottom. At present levels of saturation, however, scientists estimate that a degassing of the lake could not occur unless such a disturbance triggered the movement of deep water many tens of meters upward.<sup>7</sup> ■

<sup>7</sup> At this time, no information is available regarding how close to saturation levels gas pressures must reach before a catastrophic degassing becomes likely; nor is it known if Lac Kivu is capable of the sudden massive types of gas emission that occurred in the volcanic lakes in Cameroon in the mid-1980s. ■

**Figure 12**  
**Agricultural Production in Zaire's Kivu Regions**



## Appendix C

### Economy and Resources

#### Agriculture

Agriculture is the mainstay of the Kivus' economy. An estimated 85 percent of the population is engaged in farming activities—mainly subsistence agriculture—and, because of its rich volcanic soils, abundant rainfall, and cool highlands climate, the region is one of the most agriculturally productive in Zaire. In the late 1980s, agricultural production, processing, and marketing accounted for more than 80 percent of all economic activity in eastern Zaire, according to the US Embassy. Academic reports indicate the region is intensively cultivated and largely self-sufficient in food. [REDACTED]

The Kivus' main *food* crops are cassava, sweet potatoes, beans, bananas (plantains), and several other fruits and vegetables; corn and rice are also grown on a smaller scale. Crops are cultivated mainly on small plots—often on steep hillsides—by subsistence farmers who sell any surplus to traders or middlemen. Most of the surplus is marketed locally or in Rwanda or Burundi because of poor transport connections to the rest of Zaire. [REDACTED]

Although some food is harvested throughout the year, most crops have fairly distinct growing seasons. According to [REDACTED] US Embassy reporting, beans and corn are planted between October and December for harvesting in March through May. Sweet potatoes are planted mainly between February and May for harvest in June and July. In highland areas, where soil moisture is usually better during the June-July dry season, some farmers will plant an additional crop of different foods for harvest in mid-September. Bananas, other fruits, cassava, and vegetables are generally available year-round. [REDACTED]

The most important *cash* crops are:

- Coffee. The region is Zaire's main producer of the expensive Arabica coffee. Most is exported, and, because state-mandated prices are low, coffee

smuggling to other countries—particularly Rwanda—has been significant, according to press reports.

- Tea. About half the annual production of tea, which is grown on plantations at elevations of 1,500 to 2,000 meters, is exported.
- Sugarcane. Grown on a large plantation in the Ruzizi Valley near Kiliba, sugarcane is sold mostly to local consumers.
- Cinchona bark. Used to produce quinine, cinchona is grown near Lake Kivu for three European-owned firms. The Kivus currently produce over a third of the world's quinine.
- Papain. The region is the world's largest supplier of papain, a papaya extract used in pharmaceuticals and food additives. It is grown in the north and is sold to a Belgian-owned company in Beni.

Periodically, high prices for coffee and cinchona bark have encouraged farmers to devote more of their land to such commercial crops, adversely affecting food output in the region, according to the US Embassy. [REDACTED]

Lack of additional arable land and low levels of inputs and technology are squeezing land resources. The US Embassy reports that land shortages often prompt farmers to reduce or eliminate fallow periods and to cultivate marginal lands. Erosion—and, in some cases, the wholesale loss of topsoil—has become a serious problem in many areas because farmers have neglected to terrace fields or to implement other erosion-control techniques introduced during the colonial era. Because there is little use of fertilizers to restore nutrients, crop yields have slowly declined as the soil has worn out. Even so, Western development

experts believe that the decline in crop yields can be reversed by increasing the use of agricultural inputs and by introducing farmers to modern cropping techniques. [REDACTED]

#### **Industry and Mining**

Industries in Nord- and Sud-Kivu are based primarily on the processing of agricultural products for export. Goma has tea- and coffee-processing plants, Bukavu has a brewery and a pharmaceutical factory that produces quinine, and Uvira has cotton and sugar mills. In addition, flour, textiles, cement, meat and fish products, and tobacco are produced for local consumption. [REDACTED]

Both tin and gold are mined in the region. The Society Miniere et Industrielle du Kivu (SOMINKI)—with a labor force of some 6,300 in 1993—is the largest local mining company, according to a US Embassy report. Tin is its primary output, but the company also extracts gold at two Sud-Kivu mines, which produce 11 percent of Zaire's annual yield. [REDACTED]

[REDACTED] In addition, niobium, tantalum, and tungsten are mined in the Kivus, although low world market prices and Zaire's economic and political troubles have slowed mineral production and have resulted in layoffs. [REDACTED]

### Tourism

The tourist industry in the Kivus is not well developed, despite the region's pleasant climate, spectacular volcanic peaks, scenic rift valley lakes, abundance of wildlife, and the presence of two of Zaire's seven national parks—6,000-sq-km Kahuzi-Biega and 8,000-sq-km Virunga. In 1985, only 1.5 percent of the population was employed in tourism, according to a Government of Zaire publication. [REDACTED]

The limited tourism in the area—primarily gorilla viewing—has been hurt by the influx of refugees. Bukavu and Goma—focal points for excursions to gorilla habitats in the national parks—have several refugee camps along the roads to the takeoff points for tours. A US Embassy report indicates that as many as 60,000 refugees are settled only 7 km from the mountain gorilla sanctuary north of Goma. To date, there is no indication that the refugee presence has affected the health or the habitat of the endangered mountain gorillas, according to press reports, although researchers fear that disease from the camps or an insurgency launched from the Goma area might threaten them. [REDACTED]

### Power and Energy Resources

The region's most important sources of electricity are the two hydroelectric plants on the Ruzizi River, both of which straddle the border with Rwanda:

- Ruzizi I, with a maximum capacity of 28.2 megawatts, came on line in 1958 and is critically in need of refurbishing.
- Ruzizi II, with a maximum capacity of 40 megawatts, was completed only five years ago but, [REDACTED]

Zaire and Rwanda split electrical output and maintenance responsibilities for Ruzizi I, while Ruzizi II's output is split by Zaire, Rwanda, and Burundi. As of late 1993, poor upkeep had reduced power generation at Ruzizi I to 12 percent of capacity and at Ruzizi II to 25 percent. Furthermore, drought conditions in recent years have left insufficient water in the reservoirs, further reducing output, according to the US Embassy in Kigali. Maintenance on the 70-kilovolt powerlines

from the two facilities to Bukavu and Goma is rare, according to [REDACTED] US Embassy reports. [REDACTED]

Additional sources of electricity in Nord- and Sud-Kivu include several small hydroelectric plants and a handful of diesel-powered facilities. All but the Goma diesel plant supply electricity only to individual industrial enterprises and/or communities. The Goma plant often lacks fuel and is in need of maintenance, [REDACTED]

[REDACTED] Altogether, electricity is available to less than 2 percent of the inhabitants of the Kivu region, [REDACTED]

Methane gas is the region's most potentially exploitable energy resource. According to diplomatic reporting, the methane reserves found in the depths of Lac Kivu are among the largest of this type in the world—estimated at 50-60 billion cubic meters—and are to be shared with neighboring Rwanda. While Rwanda has constructed a successful, albeit small, methane extraction facility to support the Gisenyi brewery, Zaire has only conducted initial feasibility studies, according to US Embassy reporting. [REDACTED]

Two other resources are geothermal energy and petroleum. The numerous active volcanoes and cinder cones north of Lac Kivu are evidences of the potential for geothermal energy development. Further south, preliminary geological surveys conducted in the delta of the Ruzizi River near Lake Tanganyika have indicated the possible presence of oil, according to a US Embassy report. These reserves are yet to be confirmed and are unlikely to be economically feasible. [REDACTED]

### Telecommunications

Zaire's telecommunications network is fairly well developed by African standards, but it provides only marginally adequate service, particularly to the eastern region. Deterioration of equipment, poor maintenance, lack of spare parts, a shortage of skilled personnel, and unreliable electricity supplies are major problems. [REDACTED]

[REDACTED] as well as a radio relay satellite (REZATELSAT) station for receiving domestic radio- and TV broadcasts. The station sends AM radio signals to a station in Bukavu and TV signals to Uvira and to Goma via microwave. [REDACTED]

#### Water Resources

Lac Kivu—the region's main surface water resource—and Lac Vert have been the key sources of water for refugee camps in the north; the Ruzizi River, which drains Lac Kivu and empties into Lake Tanganyika, is an important source in the south. Also used are numerous mountain streams such as those near Katale and Rutshuru. Groundwater resources are less

plentiful, but, [REDACTED] the Ruzizi and the Rutshuru Valleys are potentially good areas for groundwater development, and the Bukavu and the Uvira areas reportedly have a number of natural springs that can be tapped. [REDACTED] spring yields in Bukavu are 360 cubic meters per day and in Uvira are 288 cubic meters per day. Several in Bukavu, however, are geothermal in origin and highly mineralized. [REDACTED]

[REDACTED] Fracture zones in the mountains are also potential sources of groundwater but have not been surveyed. [REDACTED]

~~Secret~~

~~Secret~~